



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---------------------------------------------|-------------|------------------------|-------------------------|------------------|
| 09/870,534 | 05/31/2001 | Kamalesh K. Srivastava | FIS920000349US1 | 1332 |
| 32074 | 7590 | 02/23/2006 | EXAMINER | |
| INTERNATIONAL BUSINESS MACHINES CORPORATION | | | UMEZ ERONINI, LYNETTE T | |
| DEPT. 18G | | | ART UNIT | PAPER NUMBER |
| BLDG. 300-482 | | | 1765 | |
| 2070 ROUTE 52 | | | | |
| HOPEWELL JUNCTION, NY 12533 | | | | |

DATE MAILED: 02/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------------------|-------------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 09/870,534 | SRIVASTAVA ET AL. | |
| | Examiner Lynette T. Umez-Eronini | Art Unit 1765 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 02 October 2003.
 2a) This action is FINAL. 2b) This action is non-final.
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-15 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) Claim(s) _____ is/are allowed.
 6) Claim(s) 1-15 is/are rejected.
 7) Claim(s) _____ is/are objected to.
 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
 10) The drawing(s) filed on 5/31/2001 is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ . |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____ . |

DETAILED ACTION

1. In view of the Appeal filed on 10/2/2003, PROSECUTION IS HEREBY REOPENED. A new ground of rejection is set forth below, which addresses Applicants' arguments in the brief regarding the motivation to combine Erk (US 5,340,437) and Datta et al. (US 5,462,638).

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) initiate a new appeal by filing a notice of appeal under 37 CFR 41.31 followed by an appeal brief under 37 CFR 41.37. The previously paid notice of appeal fee and appeal brief fee can be applied to the new appeal. If, however, the appeal fees set forth in 37 CFR 41.20 have been increased since they were previously paid, then appellant must pay the difference between the increased fees and the amount previously paid.

A Supervisory Patent Examiner (SPE) has approved of reopening prosecution by signing below:

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER



Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1, 4, 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US 5,340,437) in view of Datta et al. (US 5,462,638).

As pertaining to claims 1, 4, and 5, Erk teaches a method comprising the steps of:

immersing an article into a tank of etchant (column 7, lines 13-17).

Erk also teaches, ". . . the wafers are etched . . . for a period of about 1 to 10 minutes . . . wafers are rotated while they are in contact with the flowing etchant . . . the wafers are rotated at a speed less than about 5 rpm" (column 4, lines 19-26). "As the etchant flows into the etch tank, . . . the drive mechanism . . . are rotated to cause the

Art Unit: 1765

semiconductor wafers rotate . . ." (column 7, lines 17-24 and column 8, lines 30-32), which reads on rotating the article while in the etchant for an amount of time so as to cause improved uniformity of etching of the film across the entire article compared to etching without rotating the article; and

removing the article from the tank of etchant (column 8, lines 38-42).

Erk differs in failing to teach the article contains a film having a plurality of solder bump on an article and immersing the solder bumps into a tank of etchant, in claim 1 and the film is a metallic film in claim 6.

Datta teaches, "After the solder bumps are formed, . . . The substrate now is covered with . . . solder bumps" (column 3, lines 10-12). "The etchant removes Ti-W . ." It can be used with dip etching" (column 7, lines 41-44). The former reads on the article contains a film having a plurality of solder bump on an article and the latter reads on immersing the article containing the film having a plurality of solder bumps into a tank of etchant, as in claim 1 and the above further reads on the film is a metallic film, as in claim 6. Datta illustrates that wafers with solder bumps are conventionally etched by dip etching.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ any wafer, including a conventional wafer having solder bumps as disclosed by Datta in the process of Erk because Erk does not limit the specific types of wafers processed by the rotating etching process. It would appear that any wafer, including one with solder bumps, would benefit from the uniform etching

process of Erk. Applicants have not shown anything unexpected by employing a conventional wafer with solder bumps in a known process for achieving uniform etching.

5. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US '437) in view of Datta (US '628) as applied to claim 1 above, and further in view of Takeshi et al. (English Abstract of JP 9115977 A2).

Erk in view of Datta differs in failing to teach the step of rotating comprises sequentially rotating the article, **in claims 2 and 3**; and

sequentially rotating comprises rotating the article an amount but less than a complete rotating and repeating the steps of rotating and etching for an amount of time, **in claim 3**.

It is well known in the art that a complete rotation is 360 degrees. Takeshi teaches the steps of setting a fixed angular velocity so that the total angle of rotation becomes less than 360 degrees [0025 and 0028], which reads on rotating the article a predetermined amount but less than a complete rotation. Takeshi also teaches repeating the step of rotating and etching for an amount of time [0030], further reads on sequentially rotating comprises rotating the article an amount but less than a complete rotating.

It would have been obvious to modify Erk in view of Datta by using Takeshi's step of sequentially rotating an article for an amount but less than a complete rotation, and repeating the steps of rotating and etching for an amount of time for the purpose of improving the method of detecting defects in semiconductor processing.

Art Unit: 1765

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US 437) in view of Datta (US '638) as applied to claim 1 above, and further in view of Barbee (US '705).

Erk in view of Datta differs in failing to teach the film is a non-metallic film, in claim 7.

Barbee teaches a workpiece **20**, such as a semiconductor wafer comprises one or more film layers on a surface thereof, the film layers are either patterned or unpatterned (column 5, lines 42-50; column 7, lines 67 - column 8, line 7) and " . . . the removal of a conducting or dielectric film from the etched work piece **20** . . ." (column 6, lines 63-64), which reads on the article containing a film being non-metallic.

Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Erk in view of Datta by using an article containing a film as taught by Barbee for the purpose monitoring an etching condition of a workpiece being etched which does not interfere with the impingement of an etchant upon a workpiece (Barbee, column 3, lines 17-21).

7. Claims 8, 11, 12, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk ('US 437) in view of Barbee (US '705).

Erk teaches a method comprising the steps of:

immersing a semiconductor into a tank of etchant (column 7, lines 13-17);

Erk also teaches, " . . . the wafers are etched . . . for a period of about 1 to 10 minutes . . . wafers are rotated while they are in contact with the flowing etchant . . . the

Art Unit: 1765

wafers are rotated at a speed less than about 5 rpm" (column 4, lines 19-26). "As the etchant flows into the etch tank, . . . the drive mechanism . . . are rotated to cause the semiconductor wafers rotate . . ." (column 7, lines 17-24), which reads on,

rotating the semiconductor wafer while in the etchant for an amount of time; and

"The wafers are etched . . . for . . . 1 to 10 minutes . . . the flow of liquid continues . . . and the etch rack is removed from the etch tank . . . to remove any etchant which may remain on the surface of the wafers" (column 8, lines 30-42) and ". . . the wafers are rotated at a speed less than 5 rpm . . ." (column 4, lines 19-21), which reads on,

removing the semiconductor from the tank of etchant), as **in claim 8**;

rotating comprises continuously rotating the semiconductor wafer an amount of time, as **in claim 11**; and

rotating the semiconductor wafer at a speed of 1 to 5 revolutions per minute, as **in claim 12**.

Erk differs in failing to teach the semiconductor contains a film having a plurality of solder bump on an article and immersing the solder bumps into a tank of etchant, in claim 8 and the film is a metallic film in claim 14.

Datta teaches, "After the solder bumps are formed, . . . The substrate now is covered with . . . solder bumps" (column 3, lines 10-12). "The etchant removes Ti-W . ." It can be used with dip etching" (column 7, lines 41-44). The former reads on the article contains a film having a plurality of solder bump on the article and the latter reads on immersing the article containing the film having a plurality of solder bumps into a tank of etchant, as **in claim 8**. The above further reads on the film is a metallic film, as

Art Unit: 1765

in **claim 14**. Datta illustrates that wafers with solder bumps are conventionally etched by dip etching.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ any wafer, including a conventional wafer having solder bumps as disclosed by Datta in the process of Erk because Erk does not limit the specific types of wafers processed by the rotating etching process. It would appear that any wafer, including one with solder bumps, would benefit from the uniform etching process of Erk. Applicants have not shown anything unexpected by employing a conventional wafer with solder bumps in a known process for achieving uniform etching.

8. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US '437) in view of Datta (US '638) as applied to claim 8 above, and further in view of Takeshi (English translation of JP '977 A2).

Erk in view of Datta differs in failing to teach the step of rotating comprises sequentially rotating the semiconductor, **in claims 9 and 10**; and

sequentially rotating comprises rotating the semiconductor an amount but less than a complete rotation, and repeating the steps of rotating and etching for an amount of time, **in claim 10**.

It is well known in the art that a complete rotation is 360 degrees. Takeshi teaches the steps of etching a semiconductor by setting a fixed angular velocity so that the total angle of rotation becomes less than 360 degrees and etching for a fixed time [0025 and 0028], which reads on rotating the article an amount but less than a complete

Art Unit: 1765

rotation. Takeshi also teaches repeating the step of rotating and etching for an amount of time [0030].

It would have been obvious to modify Erk in view of Datta by using Takeshi's step of sequentially rotating an article for the purpose of improving the method of detecting defects in semiconductor processing.

9. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US 437) in view of Datta (US '638) as applied to claim 8 above, and further in view of Barbee (US '705).

Erk differs in failing to teach the film is a non-metallic film.

Barbee teaches a workpiece **20**, such as a semiconductor wafer comprises one or more film layers on a surface thereof, the film layers are either patterned or unpatterned (column 5, lines 42-50; column 7, lines 67 - column 8, line 7) and ". . . the removal of a conducting or dielectric film from the etched work piece **20** . . ." (column 6, lines 63-64), which further reads on the semiconductor containing a film being non-metallic, as in the claimed invention.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Erk in view or Datta by using an article containing a film as taught by Barbee for the purpose monitoring an etching condition of a workpiece being etched which does not interfere with the impingement of an etchant upon a workpiece (Barbee, column 3, lines 17-21).

Art Unit: 1765

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Art Unit 1765

Itue

February 21, 2006

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER
